

JM

WINTER 2017/2018

Informally Speaking

A formaldehyde magazine from Johnson Matthey



China market update
Conference in Chengdu
FORMOX 2.0 Technology
20 years of loading service

Demand for formaldehyde growing and new FORMOX 2.0 technology

Formaldehyde has unique and versatile properties and its applications are steadily growing, and therefore also demand. In 2017 global demand for formaldehyde based on 37% concentration amounts to 50 million tons, and average annual growth is currently 1-2% above GDP. The housing and construction industry in emerging markets continues to be the main driver, but rapid progress is being made for replacing traditional materials with lighter and advanced sustainable polymer materials. We have seen this development grow over the last two decades and by 2020 these new applications will likely be equal in demand to the traditional applications found in board and panels. What does this mean for the industry and for formaldehyde technology? Growing global competition and demand for greater efficiency in downstream applications is also creating demand for better performance and efficiency from the formaldehyde technology. Oxide technology has been around for many years and its reputation has grown thanks to high yield and

robust technology. By next year (2018) JM will take another step in this direction with our new **FORMOX™** 2.0 technology, which will introduce elevated operating pressure made possible through a unique turbocharger system and enhanced catalysts. **FORMOX** 2.0 will increase capacity by more than 30% in the same size plant and further reduce power consumption. Finally, it pleases me to see how our commitment to health and safety is taking shape partly by ensuring that our standard is consistently being used, and also by effectively communicating our safety principles and providing training in this area. These principles are of course always in focus when it comes to technology design and plant operation. We at JM would like to thank you all for a good collaboration in 2017 and to wish you Happy Holidays and Happy New Year.

Lars-Olle Andersson,
Business Manager,
Johnson Matthey



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Building a sustainable business in a changing world

This year (2107) we have been celebrating Johnson Matthey's first 200 years of inspiring science. During this anniversary year we have celebrated JM's many achievements, both in the area of sustainability and throughout our long history. We have certainly accomplished a lot over these two centuries and have helped other businesses to do the same. But what matters most now is what we do next.

Inspiring science, enhancing life

Some of the industries we serve are undergoing rapid and significant change. But we have the resources to solve tough problems. We also have the deepest commitment to research in the industry, which positions us well to meet future challenges. In coming years, JM will reach even more people and organizations around the world and our refreshed brand will strengthen this approach. You can see one of our new corporate ads on the back cover of this edition – one of the ways we are showcasing how JM's inspiring science is positively impacting the world.

JM believes companies have a big role to play when it comes to tackling the increasingly complex challenges that the world, people and society will face in the coming years. This belief is ingrained in the way we do things and in how we conduct our business.

In short, these are our sustainable business goals leading up to 2025:

1. For health and safety, aspire to zero harm.
2. Ensure that the JM organization is truly inclusive, fostering employee engagement and development within a diverse and global workforce.
3. Reduce our greenhouse gas emissions per unit production output.
4. Improve sustainable business practices in our supply chains and through collaboration, ensure full compliance to our minimum standards from strategic suppliers.
5. Increase the positive impact that JM products, services and technologies contribute to a cleaner, healthier world.
6. Increase the use of volunteer hours to support our community and charity partners through the JM employee volunteering program.

Read more about our sustainability projects:
www.matthey.com/sustainability/in-action

BY



Anna Rundblad,
Communications Manager,
Johnson Matthey

On front page:

JM Sales Manager Vivian Wang giving a presentation at Formaldehyde China 2017 in Chengdu.
Read more about this conference on page 10 - 11.



FORMOX 2.0

The next great advancement in our technology soon here

In the first part of 2018 we will release new **FORMOX™** formaldehyde technology that will boost the present productivity by more than 30%, up to 32 kg/tube/day. For our standard FS3 plant, this represents a capacity increase by 33% when comparing with today's standard 0.5 bar g operation. All while retaining the same number of tubes in the formaldehyde reactor. The investment cost for a plant per ton of capacity will thereby be remarkably reduced!

Add to that a significant reduction in power consumption per ton of product while maintaining the same high catalyst performance. Over the last 50 years the **FORMOX™** process for producing formaldehyde has raised the productivity of plants from 8 to 24 kg/tube/day thanks to various developments. The first came in 1972 when we introduced recirculation of the process gas allowing a higher inlet. This enabled more methanol to be fed without in-

creasing the air flow. Then in 1997 we introduced pressurization of the plants. To satisfy the increasing demand for formaldehyde at a single site, we have naturally designed plants with more reactor tubes as well.

Hand-in-hand development

Through the years, the development of plants and catalysts has gone hand-in-hand in order to provide an optimum solution for achieving these enhancements in productivity and capacity. For example, increasing of the productivity by augmenting the gas throughput would have led to a significant increase in pressure drop over the catalyst. So to solve this issue, the shape was altered and granules were replaced with ring-shaped catalyst particles. Moreover, when pressurization was introduced, the design of the plants had to go through major changes such as installation of a fresh air blower, change of the oxygen control concept, and redesign of the Emission Control System. Likewise, the loading plans had to be upgraded to maintain the same high performance, resulting in our latest CAP 2.0 and CAP 3.0 profiles. These circumvented the constraints induced by the higher methanol inlet and system pressure.

So how could the plant capacity be further increased? We opted for increasing the system pressure. Traditionally, this would also correspond to increased power consumption, but thanks to the turbocharger, this no longer needs to be the case. In fact, the turbocharger makes it possible to reduce power consumption (per ton of product) for the recirculation blowers as the P2/P1 (outlet to inlet pressure) will be more favorable! We could have also increased the methanol inlet further, but we are close to the limit. We could increase the gas velocity, but that comes with more costly power consumption. We could further increase the size of the plant, but we are close to the physical limits of what is practical for transportation. Hence, the "pressure route"

was favored and we focused on developing a new high-pressure formaldehyde process.

Identifying new possibilities

In our continuous endeavor to augment the productivity of the plant (and so reduce the cost of ownership), and strengthened by the experience of our latest improvements (replacement of compressor by the turbocharger, CAP 3.0 loading plan), we initiated new activities to understand how we could better use the turbocharger and identify new opportunities that it opens up for. Besides facilitating a significant reduction of the specific power consumption, we acknowledged that it also enables raising the system pressure further without negatively impacting this specific production cost.

In order to handle this increase in productivity, both the plant design and the catalyst (including the loading plan) had to be altered to cope with the new operating conditions. Concerning the plant design, an enlarged capacity involves an increase of the methanol feed to the plant, which obviously results in a higher thermal load on the reactor, condenser and heat exchangers. This is especially true for the formaldehyde reactor and HTF condenser as the steam production, when expressed per ton of product, will remain the same. As our objective was to keep the reactor as similar as possible to the present reactor, the HTF system had to be adapted. The capacity of other heat exchangers had to be increased, and so too for a number of control valves, safety relief valves, etc. Naturally, the higher pressure in the system also required a redesign of the rupture discs. The absorber has also been modified to be able to produce the same high formalin concentration while operating at a 33% higher production rate. All in all, however, the plant will look very much like the present **FORMOX** design and retain a comparable footprint.

Successful trials confirm findings

When it comes to the catalyst, just as for the plant, significant adjustments were imposed to be able to provide similarly superior performance regarding yield and specific production in spite of the higher pressure and methanol feed. After a few years of intense R&D activities, which have resulted in a new catalyst formulation, we are reaching the final steps of this development. We initiated a specific test program together with our customer Masisa (Durango, Mexico) to confirm the lab- and pilot-scale results. The trial, which began during summer 2017, is being done in Masisa's newly built plant and has so far confirmed the findings in the lab. Not only do the new catalyst and loading plan allow operation at this higher pressure, but also enhance performance when operated at partial load. Moreover, Masisa has reported that the ease of operation remains and is to some extent smoothened by the integration of new operating tools.

We are all very excited about this important evolution of our **FORMOX** formaldehyde technology that will provide, for nearly the same investment, much larger capacity (i.e. significantly lower cost per ton of capacity), as well as reduced operating cost for the formaldehyde production. This is perfectly in line with our commitment to offering more efficient use of natural resources when producing formaldehyde. We all look forward to discussing this new opportunity with you.

BY



Andreas Magnusson,
Product Manager Plants



Philippe Thevenin,
Product Manager Catalysts

This is what you think of us!

At Johnson Matthey we always strive to help our customers make better business. That is why we on a regular basis make global customer surveys to see what you are satisfied with and what you want to change. We want to thank all of you that offered your time to participate in this years survey and we are very happy to say that the result is very good. An index over 40 on the question "To what degree would you recommend JM (FORMOX) to a colleague?" is actually con-

sidered "world class" according to TradeWell, the company that conducted our survey. We got an index of 57 which we are very proud of!

The total index of "How satisfied are you with JM (FORMOX) as your supplier and partner?" had gone down a bit from 4,47 to 4,36. Still on a very high level but our analysis say that some of you could be more satisfied with our ability to offer new products

and also that our Technical support needs to be pushed to an even higher level.

BY



Anna Rundblad,
Communications Manager,
Johnson Matthey

Keeping up with ISO

to deliver the best products and services in an efficient way. The certificate is verification that we have succeeded. Everybody working within Johnson Matthey's formaldehyde business has contributed to where we are today, and the work will continue. The internal quality work is a continuous process and permeates the entire organization. But we need input from our customers in order to focus on the right things.

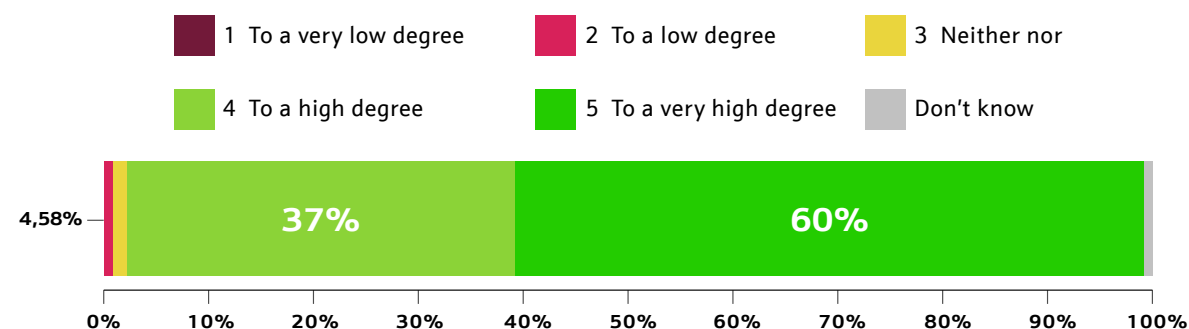
Environmental issues, as well as safety and health, are very important to us. JM strives to minimize the environmental impact of our processes and products, and the life-cycle perspective is a part of our way of working. By keeping records of the environmental aspects for all parts of the business and taking actions where required, the environmental work can keep the right focus. Repurchasing and reprocessing of spent catalyst is one important part of our environmental work. But we do more than that, e.g. introducing new designs for both newer and older plants, and advising customers on how to operate their plants in ways that minimize their environmental impact.

BY



Maria Yngvesson,
Quality Manager,
Johnson Matthey

Net Promotor Score Index 2017 - NPS 57



39: To what degree would you recommend JM (FORMOX) to a colleague?

The results show the situation during summer 2017.

The management system for Johnson Matthey's formaldehyde business has now stepped up to a new level. In October 2017, the business in Perstorp, Sweden, showed that its management system complies with the requirements of the new ISO standards, ISO 9001:2015 and ISO 14001:2015. After a two-day audit, our external auditors were pleased at how we have implemented the principles of the two new standards in our management system.

The formaldehyde business, when owned by Perstorp AB, was initially certified to ISO 9001 in May of 1994 and to ISO 14001 in September of 1998. Since then, the man-

agement system has been developed to be more robust and flexible, for example by being independent of organizational changes. By thinking in terms of processes instead of grounding the management system on the functional organization, the strategy is clearer to everyone working within the business. The process map shows that the key factors to success are Customer focus, Create value and Collaboration.

The objective of our internal quality work is to meet, and hopefully to exceed, the expectations and needs of our customers through continuous improvements, and



Update China Formaldehyde market

Market update

China is the biggest formaldehyde market with a total installed formaldehyde capacity in 2015 of about 44m MTPA @37% and output of around 28m MTPA@37%. The silver process is dominating the market, making up about 80% of all capacity in China. But the silver formaldehyde industry is too dispersed. About 35m MTPA silver formaldehyde capacity is distributed to more than 600 producers and about 900 plants around the country. The application of silver formaldehyde is mainly for wood-based panels.

Legislation update

Due to the gravity of the pollution and safety issue in China, the central government has issued stricter and stricter legislations. One important measure calls for 'all the chemical plants to be moved to chemical industry parks'. The deadline for this move depends on the region. For example, for many cities in Shandong and Jiangsu provinces, the deadline is 2020. For some cities it is 2019.

At the same time, the government has raised requirements and standards for chemical industry parks, and is reviewing all existing parks particularly in the Shandong and Jiangsu provinces. If an existing park does not meet the new standards, approval will be cancelled. In the foreseeable future, chemical industry parks represent a limited resource for the entire chemical industry, not just the formaldehyde industry.

Industry transformation

Currently only a few silver formaldehyde plants are located in qualified chemical industry parks. This means that almost all the formaldehyde capacity in each region must relocate to a chemical industry park before 2020.

The strictest policy and formaldehyde concentrated regions are the Shandong, Jiangsu, Henan and Anhui provinces. In 2015 the installed silver capacity in these four regions amounts to about 19m MTPA, with output of about 14m MTPA. During this relocation period, capacity will be more concentrated. So scale-effective plants will be more competitive. Meaning the oxide process will be more competitive than the silver process. Therefore, a huge amount of oxide capacity will be built over the coming 2-3 years to replace the silver capacity, especially in the above four regions.

Formaldehyde Industry in China (includes oxide and silver process) ¹⁾

Year	2011	2012	2013	2014	2015
Installed FA Capacity million MTPA @37%	29.92	31.57	35.73	46.04	44.45
Output million MTPA @37%	19.54	21.23	24.22	29.27	27.20

1) Data from "China FA Industry 13th 5-year-plan Guideline" by China FA Association.

BY



Huamin Zhang,
Sales Manager
Johnson Matthey



Launch of new FORMOX 2.0 technology at FORMAL- DEHYDE CHINA 2017



About 100 guests from China and countries in Southeast Asia joined the Formaldehyde China 2017 conference in Chengdu from 17th to 20th of October. Andy Chaplin, Business Solutions Director JM, and Eric Li, Commercial Manager JM, gave the opening speech to thank all guests for participating and to share their experience and expertise on formaldehyde plant operation. They also used the opportunity to give an update on market information and industrial policies, speak about our new technology, and to celebrate our 200th anniversary together with Johnson Matthey members.

This was the perfect arena to launch our

new **FORMOX** 2.0 generation technology with high-pressure operation, leading to 1/3 more formaldehyde capacity with no additional investments. Roughly 60% of the participants were from existing accounts and the rest were potential customers with high interest in our technology and catalyst.

Representatives from China Formaldehyde Association and China National Petroleum & Chemical Planning Institute joined together to thank Johnson Matthey for an influential conference in the Chinese formaldehyde industry and to congratulate us for 200 years in business. In addition to the presentations, Johnson Matthey offered

one and half days of technical training for existing customers.

This was the third Formaldehyde China conference organized by Johnson Matthey since we started in 2013. Currently the conference is held every second year to bring more value to customers in an efficient way.

BY



Eric Li,
Commercial Manager,
Johnson Matthey

Interview with customers at CHENGDU CONFERENCE

OCTOBER 2017

BY



Mei Zhu,
Sales Representative
Johnson Matthey

Mr. Deng from Yanchang:

I'm surprised to see so many customers coming to Chengdu conference. It shows JM formaldehyde process has played a dominant role in China market. My purpose of attending the conference is to learn about the formaldehyde market and the latest advanced technology from JM. I am interested in topics focusing on the comprehensive analysis of the formaldehyde market including the domestic policy and development trend, as well as downstream product forecast.

Mr. Lu from Nantong Jiangtian

I appreciate that JM provides a platform for formaldehyde customers in China to get together in Chengdu. We have a chance to get to know each other and discuss technical issues with JM engineers. I think this conference is better than ever. The content of the presentations is more abundant than before. I am interested in the JM presentation regarding the absorber operation and catalyst CAP 3.0. This information can help us to solve some problems in production. It would be best if an existing customer could be invited to the next conference to introduce their successful experience.

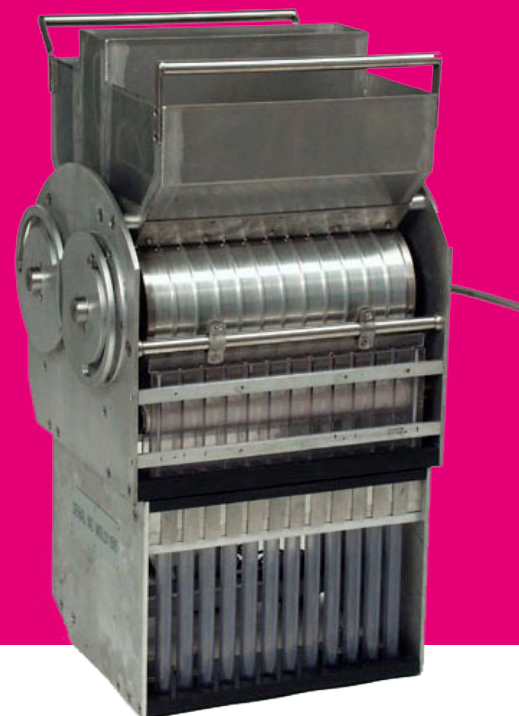
Mr. Lin from Taiwan Formosa Plastics

This is my first time attending the conference held in mainland China. I thank JM for the hospitality and for organizing the technical training for customers from Southeast Asia. The topic I am interested in is the deflagration and flashover, and how to safely operate the unit. I hope to be given more free time to exchange the operation experience with other clients in next conference.

Mr. Li from Shandong Yucheng

I am attending the conference as a new customer in wood market. For me the purpose of participating in the conference is to learn about JM oxide formaldehyde technology and catalyst. China's government is paying more and more attention to the environment, and we are considering building the new unit with the oxide process to replace the silver process. I intend to visit Perstorp plant in November.

“ We are really happy that we can now offer full loading services in Europe and North America ”



20 years of loading service with JM

FORMOX catalysts have been loaded into reactor tubes with the assistance of loading machines for more than two decades now. Already in the 1980s, plexiglass machines were developed (by a.o. Bengt-Åke Hansson, previous loading supervisor) to shorten downtime when loading the reactors, and these were rented to customers. However, it was not until the mid-90s when a greater resemblance to today's loading machines appeared, using other material combinations. The new, improved loading machines mentioned available for rental were highlighted already in the first edition of Informally Speaking in 1995. In 1997 we decided to combine the loading machine rental with a mandatory supervisor for operating the machine in the most efficient way.

Torbjörn Karlsson and Mats Börjesson were the first loading supervisors to be displayed in Informally Speaking, and the first articles about the services appeared in 1998, 2000 and 2001. Between then and Bengt's retirement in 2014, when Allan Larsen took over, only two other articles

about our loading service have appeared (2006 and 2008).

One reason why articles about our loading service have not appeared more frequently is that the service has, to some extent, sold itself. Customers' praise about the performance of the machines operated by Bengt, Allan and other supervisors has spread over the years. Our feeling had long been that the service was highly appreciated, but when Allan took over after Bengt nearly 3 years ago we conducted a survey just to be sure. We asked you about your experiences and opinions with regards to the loading service, and we were very happy to receive such a high score along with some good comments and tips for improvements.

Coordination and safety critical when loading a reactor

Reloading can be seen as a four-step exercise involving vital procedures with regards to catalysts. These steps are preparation, unloading/loading, inspection and taking

care of spent catalyst. Preparation involves knowing which materials should be used, how much of each is needed and already available in stock, and the planning and timing of the reloading. When contacting us for catalyst it is a good idea to make a preliminary booking for the service. The second step, unloading/loading, can be divided into these main procedures: reactor ready for unloading (safe to enter), unloading, the importance of clean tubes (brushing most common choice), inspection after cleaning, and finally loading. After loading it is imperative that a thorough inspection of all the tubes be done to ensure that all tubes have been loaded. Any unloaded tube means loss of money (higher methanol in product and lower yield) and an increased risk of fire after the reactor. And finally, it is important to take good care of the spent catalyst material before returning it to Perstorp for recovery. This means keeping it dry in either big-bags (preferably) or drums, and away from moisture.



Ronnie, Kent and Lars shaking hands at our office over a cooperation that will last for many years to come.

Getting back to Mr. Karlsson

We know that there is a desire among more customers to utilize the unloading service. Yet the increase in the number of reactors to be reloaded has prevented us from moving forward with the unloading machine according to our plans. So we contacted Torbjörn Karlsson – remember him from the start of this article? Over the years Mr. Karlsson has been providing loading service to our previous owners, Perstorp. About a year ago we began a cooperation with Mr Karlsson, or rather with his sons Kent and Lars (Haag) (see picture above), as Torbjörn is now retired. This means that

together with Allan Larsen's team, we now have more personnel and machines available to manage the increase in demand for performing loading services.

Expanding with full service concept

We are really happy that we can now offer full loading services in Europe and North America. This means that unloading, brushing (if needed) and loading is all taken care of by our team, so there is no need to for you to coordinate two separate teams for a reload, thus reducing total downtime. A reactor with 14,600 tubes can now be

reloaded in 2.5 days. When market conditions are favorable, as they are in Europe at the moment, this savings can lead to increased revenue for your plant. So, as we celebrate 20 years of our loading service we are now also happy to expand it with our new full-service concept that we are sure will be just as appreciated.

BY



Ronnie Ljungbäck,
Commercial Manager Catalysts,
Johnson Matthey



Refresher training in Perstorp

Last year's refresher training success concluded with a clear need for organizing a new one in 2017 due to many new requests from a lot of customers across Europe and worldwide.

By following up on previously received feedback, and after some internal discussions, several updates were introduced in the training. One of these was a significantly more complete and extended lecture concerning **FORMOX** catalysts. Also, more focus was placed on the latest plant design developments. Other topics included process description, plant operation,

incidents and troubleshooting. Visits to the Perstorp formaldehyde plants and the R&D unit were organized as well. Once again, customer satisfaction was very high and several requests for a new training have already been received. A very friendly and pleasant atmosphere was felt throughout the training week, and participants very much appreciated the level of

organization and hospitality they experienced.

BY



Alejandro Perez,
Technical Support Manager,
Johnson Matthey



More trainings

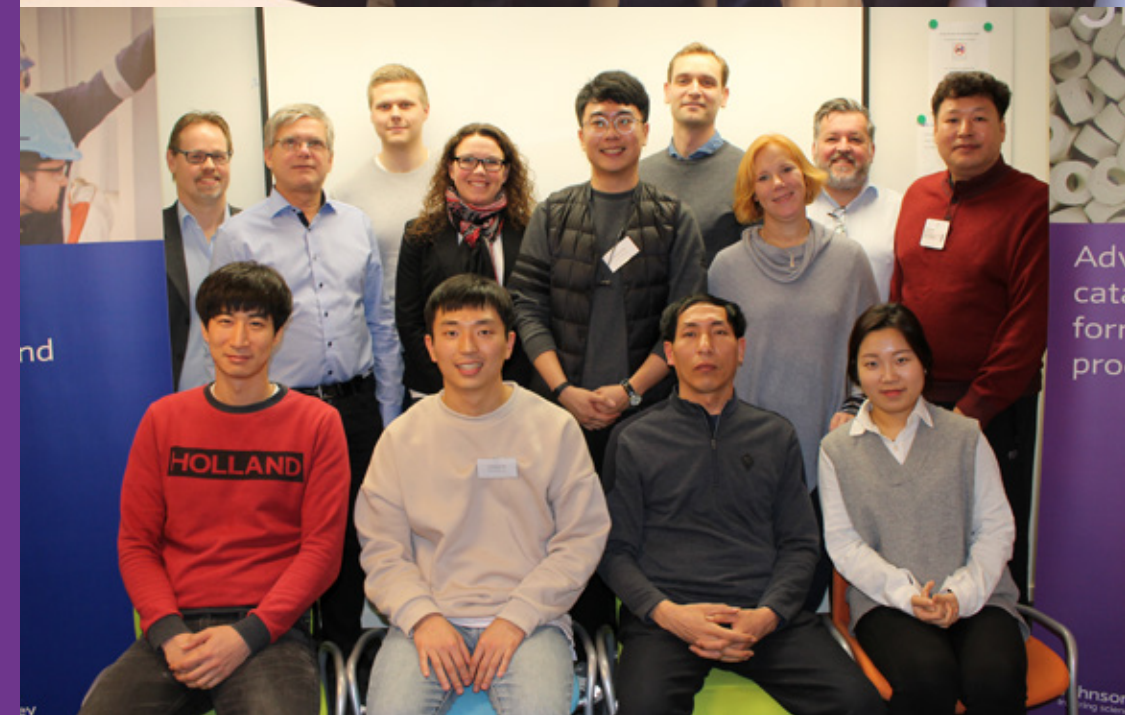


At **Polyplastics Kuantan** Plant in Malaysia, Eddy, Tomas and Philippe held a Training with focus on the CAP 3.0 concept in October 23-25.

Receiving the diplomas after passing Paul and Alex's Training at **Kronospan Ltd Chirk** in Wales, November 15-16.



We held a Training for **Kolon Plastics**, South Korea, in Perstorp, December 4-8.



HOT SPOT temperatures

BY



Simon Smrtnik,
Regional Manager
Technical Support,
Johnson Matthey

We often receive questions on how to interpret hot spot temperatures, so this article is written to provide you with some insight.

The reactor contains several thousand reactor tubes filled with **FORMOX™** KH-catalyst. Some of these, usually between 5 and 9 (depending on year of design), contain multitube thermocouples for monitoring temperature at nine positions along the catalyst loading profile. Consequently, there are thermoelements in every layer of the loaded catalyst profile. The main purpose of these multitube thermocouples is to follow the reaction intensity and distribution along the reactor tube, to ensure that the catalyst is optimally utilized inside the reactor tube.

Hot spot temperature

The highest temperature noted in a reactor tube with a multitube thermocouple is the so-called "hotspot temperature," and can be found in different positions depending on the age of the catalyst. If hotspot temperatures are moving downwards due to decreased catalyst activity or to process adjustments, e.g. in the process gas flow, system pressure or methanol feed (capacity), this should be balanced by trying to preserve the reaction pattern (position) in the reactor. For example, increasing the methanol feed results in increased hotspot temperatures higher up in the reactor tube. This should then be counteracted by decreasing the HTF temperature in order to reach the same reac-

tion position as before, given that this was the optimal position prior to the change. The hotspot temperatures are a valuable piece of information, but it is very important that they are assessed in the context of other process parameters in order to gain a complete picture of catalyst performance. Such parameters include yield, methanol in product, CO concentration, delta temperature (temperature difference of process gas from reactor and HTF), ECS delta temperature, etc. Furthermore, after about half the catalyst lifetime, the hotspots can be more difficult to interpret since they may not be representative of the rest of the catalyst-filled reactor tubes. This is due to the fact that the presence of the multitube is influencing the flow and ageing and reaction in these tubes, and in some cases these tubes may also contain slightly less catalyst compared to the surrounding tubes, influencing the ageing as well.

Taking action

Corrective action should be taken to try to lower hotspot temperatures that are locally high in order to avoid damaging the ther-

mocouple elements – catalyst can also be at risk, but only if this seems to be a general problem in the reactor. If the process conditions are stable and other hotspot temperatures do not indicate any reactor anomalies that would require stopping the production, then individual high hotspots can be disregarded. In newer JM **FORMOX** plants the multitube thermocouple temperatures are implemented in a trip logic that will stop the methanol flow if a certain temperature pattern is fulfilled for temperatures of 475 °C or higher, in order to protect the catalyst.

However, if very high temperatures are observed in one multitube, one protective measure could be to plug that reactor tube

Void	Multitube								
	Pos.	1	2	3	4	5	6	7	
Inerts	1	277	279	276	280	278	276	277	277
	2	305	299	301	310	303	307	315	306
	3	345	341	320	351	315	360	339	339
	4	339	334	337	340	347	342	320	337
Catalyst	5	320	318	326	321	319	335	319	323
	6	323	330	338	318	334	318	330	327
	7	333	312	309	325	307	329	346	323
	8	315	301	298	303	298	302	310	304
Inerts	9	286	284	283	287	281	286	290	285
	HS 1	345	341	337	351	347	360	339	346
	HS 2	333	330	338	325	334	329	346	334



from being used during the rest of the existing catalyst load given that the catalyst is aged, otherwise the catalyst can be reloaded in this particular tube, in case it is early (SP 1-5) in the run; please discuss with your local JM representative in case being in doubt. Remember, if the HTF level is sufficient in the reactor system then there is adequate cooling in the reactor. And therefore there is no risk of the reactor tube wall being damaged by high temperature on the process gas side of the reactor tube, as the reactor wall temperature will be close to the HTF temperature on the shell side.

Adjusting HTF temperature

The HTF temperature should be regularly adjusted every week, or every second week, to keep a good reaction profile over the catalyst in the reactor tube. This is because the catalyst activity is gradually decreasing due to the ageing and must be balanced by increasing

the HTF temperature. Otherwise, there is a risk that the HTF temperature must be increased significantly during the end of the catalyst lifetime in order to maintain good reaction conditions. This is less effective than having gradually increased the HTF temperature over the catalyst lifetime. However, jumping hotspot temperatures may still appear at the end of the catalyst lifetime due to aged catalyst. In this case HTF adjustments may not be effective for keeping the temperatures stable and must instead be counteracted by a capacity decrease. So, to conclude, the hotspot temperatures are important and provide vital information about the reaction intensity and distribution, but they should be assessed together with other process parameters for deciding on corrective actions. High hotspot temperatures are not necessarily a sign of abnormal reaction intensity throughout the entire reactor, but perhaps just in the particular reactor tube where the multitube thermocouple is positioned.



Mo update

Although this article is about molybdenum, I will start off with formaldehyde. This year, we have noticed that the formaldehyde industry in Europe is doing well and on a very high utilization rate. This is indicated by a high demand for formaldehyde and more requests for both new plants and current plant upgrades; we have signed agreements for both types during this year. North America has shown similar signs, and in China we have learned about the need for large restructuring of existing formaldehyde plants during the next few years.

These indications, together with a balanced supply-demand situation on the world market for oil (an expected increase in price in 2018), and expansion of LNG networks globally, gives reason to believe that there will be an increased demand for steel, including special steels with high molybdenum content in the coming years. Furthermore, in the Energy sector, solar

and wind power are growing and they are both requiring significant amounts of molybdenum. Molybdenum, as earlier explained, is either a primary or secondary product (e.g. byproduct to copper) and, comparing to the past, the outlook according to various analysts indicates that the contribution from secondary mines will decrease.

All these signals are pointing towards a gradual increase in price over the coming years. In my previous update, I estimated the molybdenum price to remain fairly stable during 2017, being within a range of 5-8 USD/lb and the price has stayed in the 7-8 USD/lb area during the year. I also wrote that I believed the price would probably be in a range of 8-12 USD/lb in 2018, but then drop back to around 10 due to increased availability of molybdenum. Based on this year's development and the recent views from various analysts, I still believe we will see slightly higher price

levels (8-12 USD/lb) in 2018, but maybe the supply will not keep up with demand, pushing the price higher in 2019-2020 instead of returning to around 10 USD/lb in 2019. There are of course many uncertainties related to regional economical and political developments, which can influence the world economy and the demand for the molybdenum. However, with no major changes, we should probably expect the molybdenum price to continue grow slowly upwards rather than returning to earlier levels (1982-2002 around 4-5 USD/lb).

This is my present view, but as always, we continue our strive to keep reasonably stable net prices regardless of the market changes. Your efforts to return spent catalyst in good condition to our catalyst recycling system has a strong contribution. By treating it as a valuable raw material and according to our specifications, you help keep catalyst prices stable!

BY



Ronnie Ljungbäck,
Commercial Manager Catalysts,
Johnson Matthey

Avoiding foam in the absorber

The absorber is an important step in the production of formalin, and foaming is a problem that can limit the plant's production capacity. There are several methods for minimizing foaming in the absorber, and in this article we will discuss some of them.

In most cases, foaming in a separation process is not desired as it will affect the hydraulic and mass exchanging between gas and liquid. If foam is restricted in space and does not collapse, absorber performance worsens. As foam can easily be carried over by gas, entrainment is another serious consequence of foaming. Entrainment will bring a lot of liquid upwards, possibly leading to flooding that restricts capacity.

In a formaldehyde plant, the aqueous formalin has less tendency to foam with low methanol in the bottom of the absorber (1wt% in 37wt% FA). As only about 50% of the methanol entering the tower is absorbed, the rest leaves through the absorber where most is recycled back to the reactor. Normally you can see a little bit of foaming in the product sump as the catalyst becomes aged and there is more methanol in the product. This kind of foaming does not have any impact on absorption, as there is a large void in the bottom of the absorber.

For caustic adding plants, the pH at the top must be properly controlled (pH 8-9). If too much caustic is added, foam can form. This very easily leads to flooding in the absorber as a result of serious entrainment upwards.

Besides these two types of foaming, we have also seen some foaming on the bubble cap trays above tray no. 10 in a two-absorber design, and packing section 3 in a one-absorber design, when running at a high gas flow (more than 90% of design rate). To overcome this issue the idea is to let the methanol in the absorber move upwards. This can be controlled by adjusting the temperature profile along the absorber to force the methanol to stay in the vapor phase for as long as possible. Having more cooling in packing section 2 of the one-absorber design, and packing section 3 of the two-absorber design, as well as increasing the temperature at the top and bubble cap

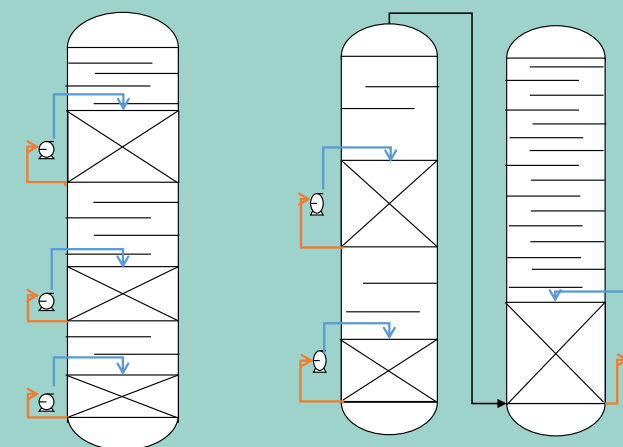
trays, can help to minimize the foaming issues.

If you would like to further discuss the foaming situation in your plant, please contact your Regional Technical Support Manager.

BY



Jianguang Zhang,
Technical Service Manager
Johnson Matthey



Some areas in the absorber are more sensitive to foaming, e.g. above bubble cap tray 10 in the design to the right and PS3 in the design to the left. It is the high concentration of methanol in this area, together with high gas flow, that causes foaming.

Projects & Start-ups

Save the date:

Formaldehyde Europe 2018, May 28 - 31

This conference will be held in Helsingborg & Perstorp, Sweden.
More information will be announced soon.

New projects

- An agreement for an FE2 plant to a client in Southern Europe has been signed.

Ongoing projects

- The new project to a client in China for an FT3 plant is in the design phase.
- Works on an FS1 plant to a client in Southeast Asia is in the design phase.
- The new FS3 plant to Eastern Europe is approaching shipping.
- The FS1 plant for a client in the Middle East is approaching the shipping phase.
- The new project to a client in Asia, for expansion of their existing plant with UFC production, is in the shipping phase.
- The FT3 plant to **KOLON BASF innoPOM, INC** (joint venture between KOLON PLASTICS and BASF) is in the construction phase. The plant will be located in Gimcheon-Si, South Korea.
- The FT3 plant to be supplied to **Wanhua Chemicals Group Co. Ltd.** in Yantai, China is proceeding well with construction. This will be their second **FORMOX** plant from Johnson Matthey on this site.
- The FS3 plant for **Xinjiang Xinye Energy Chemical Co., Ltd**, located in China, is in the installation phase.

Start-ups

- The FT2 plant in the Middle East went on stream in May.
- The new FS2 UFC plant to **PT Dover Chemicals** in Merak, Indonesia was successfully started in June.
- The project with an FS3 plant for a client in Eastern Europe went on stream in June.
- The FS3 plant for a client in Asia went on stream in late August.
- The project with an upgraded reactor for a client in South America went on stream in August.
- Two FT3 plants located on a site in China went on stream in September.
- The **FORMOX** FT3 plant from Johnson Matthey to a client in Eastern Europe went on stream in late September.

BY



Jonas Lindborg,
Chief of Projects,
Johnson Matthey



Johnson Matthey at seminars

1. Andreas Magnusson gave the presentation "Formaldehyde for the 3rd century" at the biennial International Methanol Technology Operators Forum (IMTOF) July 9 - 12 in London, UK. This event, hosted by Johnson Matthey is open to all methanol plant operators and project developers worldwide.
2. 8th International Wood Adhesive Conference 2017 in Kuala Lumpur, Malaysia, on June 15. Lars-Olle Anderson talked about "Formaldehyde Outlook 2017".
3. 20th IMPCA Asian Methanol Conference, November 7 - 9, in Singapore. Also here, Lars-Olle Andersson talked about "Formaldehyde Outlook 2017".



New faces:



Carina Hugosson,
Financial Controller



Sasa Ilic,
Process Operator



Peter Jannerstig,
Instrumental & Automation
Engineer



Carina Persson,
Senior Process Engineer



Staffan Jakobsson,
Process Operator



Mats-Ola Andersson,
Process Operator



Carina Ehk,
HR Manager

Confined space training

A formaldehyde plant is a safe working place, but unavoidably involves situations where people's safety is put at risk if the workers are not correctly trained and the risks are not correctly mitigated/understood/handled. One of these situations is the necessity of working in so called "confined spaces," meaning areas where the possibility of getting in and out are limited and where the environment could be hazardous for the worker.

Safety and security at work are a priority for Johnson Matthey, and therefore a collaboration with the Swedish company Industrial Rescue & Safety Equipment (IRSE) was organized for our process engineers and technical support managers. It involved training on how to work in confined spaces, and it took place in October 2017 at IRSE's facilities in Gothenburg, Sweden.

The training contained a theoretical segment to discuss risks that can arise in this kind of environment, as well as how they can be

minimized. Some of the topics included were "break & lock", gas measurements, ventilation, personal safety equipment, entrance and evacuation.

A practical segment was included as well. Here, real working situations, such as climbing down and up in a tunnel using a pulley, or carrying someone unable to move through narrow passages, were practiced.

The training received very good feedback and was very much appreciated by most participants.

BY



Alejandro Pérez,
Technical Support,
Johnson Matthey



A formaldehyde magazine from Johnson Matthey

The newsletter Informally Speaking aims to provide information about formaldehyde in an informal forum and is published twice annually by Johnson Matthey for its customers and contacts in the formaldehyde business. The information included herein is part of our customer service and in no way entails or implies any undertakings, legal responsibilities or liabilities.

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At Johnson Matthey our vision is for a world that's cleaner and healthier. Our scientists work every day developing innovative products that provide cleaner air, improved health and enable more efficient use of natural resources. As a global leader in sustainable technologies we work with our customers across markets from pharmaceutical and medical to automotive, industrial and chemical production, optimising processes and improving efficiency. Our solutions continue to evolve with the changing demands of our time as we tackle new challenges to build a cleaner and healthier future for generations to come.

To find out more visit matthey.com